BRIEF SUMMARY OF THE INVENTION

The present invention comprises an electrodeless fluorescent lamp that includes an envelope, often glass, containing a discharge gas (for example, a mixture of inert gas and mercury vapor) with an enclosure extending between the envelope and an Edison type socket. A ferrite core and an induction coil, typically made from Litz wire, are positioned adjacent the envelope, typically inside of reentrant cavity formed in that envelope. A cooling structure comprises a high thermal conductivity material such as a metal (typically aluminum or copper) tube positioned inside of the core and a thermally coupled high thermal conductivity material (typically ceramic) cylindrical structure that is also thermally coupled to an Edison type socket with material having a high thermal conductivity, or is formed in part as a wall portion between the envelope and the enclosure. The core extends past the tube in a direction away from the enclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1A and 1B are mutually perpendicular cross-sectional views of a first embodiment of the present invention for an electrodeless compact fluorescent lamp,

Figures 2A and 2B are views illustrating how magnetic and cooling structures are relatively positioned,

Figures 3A, 3B and 3C show representations of instantaneous magnetic fields in the vicinity of a magnetic core, and in the vicinity of a further disk in the last two instances that is formed of a magnetic material,

Figure 4 is a cross-sectional view of a second embodiment of the present invention for an electrodeless compact fluorescent lamp,

Figure 5 is a graph showing the run-up temperatures of a portion of the interior of such a lamp,

Figure 6 is a graph showing coil/ferrite power losses as a function of the total lamp power in such a lamp for three lamp operating frequencies, and

Figure 7 is a graph showing the lamp power efficiency and efficacy for such a lamp as functions of lamp operating frequency.

DETAILED DESCRIPTION

Referring to Figure 1A, a bulbous envelope 1 made from glass has a reentrant cavity 2 with an exhausting tubulation 3 located inside the cavity 2 on its axis (or possibly off axis). Tubulation 3 extends from a bottom 4 of envelope 1 in that figure. The fill inert gas (argon, krypton, or the like) is provided in envelope 1 at pressures from 0.1 torr to 5 torr (13.3 Pa to 665 Pa). Figure 1B is a cross-sectional view of the electrodeless fluorescent lamp shown in Figure 1A taken along section line A-A'.

A mercury amalgam mass (or mercury dispenser) 5 is positioned in tubulation 3 and controls in part the mercury vapor pressure in the envelope. A coil 6 made from multiple insulated stranded wire (Litz wire) is wound around a ferrite core 7 and carries therein during lamp operation oscillatory electrical current provided by an oscillatory driver circuit provided in the lamp and the associated impedance matching circuitry therein. Ferrite core 7 was made from MnZn material (see U.S. Patent Application 09/303,951 by Chamberlain et al.) and is disposed in reentrant cavity 2 outside envelope 1. Coil 6 and ferrite core 7 are maintained at temperatures below the Curie point (<229°C) of the core with the aid of a cooling structure made from a metal having high thermal conductivity and low RF power losses (only relatively small eddy currents are generated therein during lamp operation by magnetic fields like those encountered during such operation) such as aluminum, copper, or the like. The cooling assembly comprises a metal tube 8 positioned inside ferrite core 7 and a cylinder 9 (cylindrical portion of that structure) located inside an Edison type socket 10, this cylindrical portion having an adjacent outer portion thereof with a diameter close to that of the inner diameter of Edison type socket 10. Socket 10 is for a screw-in engagement of the lamp into